Visibility at White Sands National Monument

Importance of Clean Air

Clean air that is free of impacts from air pollution is essential to the integrity of national parks. Both the Clean Air Act and the National Park Service (NPS) Organic Act of 1916 protect air quality in national parks, and NPS managers have a special responsibility to protect park natural and cultural resources.

Most visitors who come to national parks expect clean air and clear views. At White Sands National Monument (NM), vistas of the surrounding San Andres and Sacramento Mountains and the Tularosa Basin are essential aspects of the park. However, White Sands NM lies downwind of major pollution sources in Texas, other U.S. states, and Mexico. Air pollutants carried into the park can diminish air quality, impair visibility, harm natural and scenic resources (such as native vegetation, soils, springs and fish), and impact human health.

Introduction to Visibility

Visibility, the ability to clearly see color and detail in distant views, includes both how far we can see and how well we can see. Visibility can be impacted by haze, which consist of fine particles and gaseous air pollution in the atmosphere. Regional haze can result from particles that can stay suspended in the atmosphere for many days and be transported for hundreds of miles.

Haze is caused by the scattering and absorption (extinction) of light by suspended particles in the air. The composition of the particles varies depending on their human and natural sources.

The NPS assesses the impact of haze on visibility using the haze index. The haze index is derived from calculated light extinction measurements, is designed so that changes in it correspond to incremental changes in visual perception across the entire range of conditions, and is measured in units of deciviews (dv). As light extinction and dv increases due to the presence of air pollutants, visibility decreases.

Information about visibility in White Sands NM is derived from data collected at the nearby Bosque del Apache Wilderness Area, a Class 1 area. Class 1 areas have the highest level of air quality protection under the law, and include large national parks, national wilderness areas and certain other areas that were in existence (or authorized) on August 7, 1977.

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Visibility is monitored in Class 1 areas as part of the IMPROVE program, a cooperative effort that includes the U.S. Environmental Protection Agency, U.S. Forest Service, NPS, U.S. Fish and Wildlife Service, Bureau of Land Management, National Oceanic and Atmospheric Administration, and several interstate air-quality management organizations. IMPROVE modules collect four independent samples every three days via a system of filter that collect different particle sizes and types.

White Sands NM Air Quality Condition and Trend 2015: Visibility

Haze Index

Condition: Moderate concern

Trend: For 2006–2015, the trend in visibility remained relatively unchanged on the 20% clearest days and remained relatively unchanged on the 20% haziest days

Confidence: High

Haze Impacts at White Sands NM include:

- Reduction of the average natural visual range;
- Frequent impairment of scenic vistas by haze.

Information is from the 2015 Air Quality Summary produced by the NPS Air Quality Division. Condition status is based on NPS Air Resources Division benchmarks and the 2011–2015 estimated visibility on mid-range days of 5.5 deciviews (dv) above estimated natural conditions. Unchanged trends are based on the lack of statistically significant trends. Visibility condition and trend are both expressed in terms of a Haze Index in deciviews (dv); however, the benchmark metrics are different. Condition assessments are based on estimated five-year average visibility on mid-range days (40th to 60th percentile) minus the estimated natural visibility condition on mid-range days. Visibility trends are computed from the haze index values on the 20% haziest days and the 20% clearest days. The degree of confidence is high because there is an nearby visibility monitor. Visit https://www.nature.nps.gov/air/data/products/parks/index.cfm for additional information.

Visibility Monitoring Data

Using data from ongoing, long-term air quality monitoring in White Sands NM, the NPS reports on the condition and trend of visibility in the park using the haze index and the composition of haze. The haze index is a measure of visibility derived from calculated light extinction measurements. The haze index, in units of deciviews (dv), is calculated directly from the total light extinction. Uniform changes in the haze index correspond to uniform incremental changes in visual perception across the entire range of conditions from pristine to highly impaired.

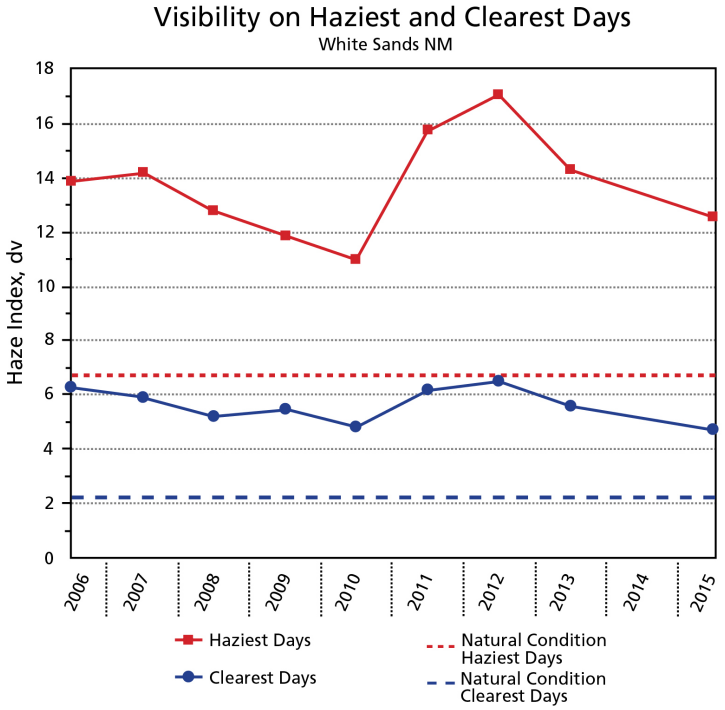
Data from 2006-2015 show that the annual average haze index for the clearest days ranged from 2.5 to 4.3 dv greater than clearest days under natural conditions. For haziest days, the average annual index ranged up to 10.4 dv greater than natural conditions, representing a reduction in visible range from about 120 miles (193 km) during natural hazy conditions to approximately 40 (64 km) miles.

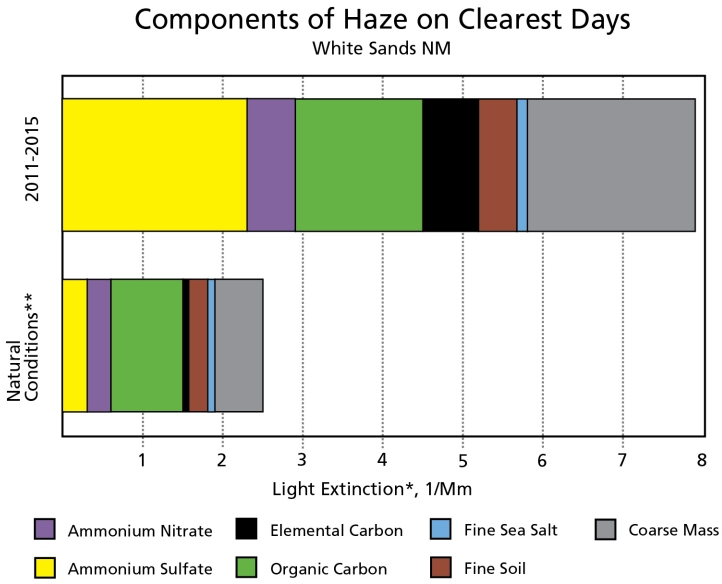
The main contributors to haze at White Sands were ammonium sulfate (primarily from coal-burning power plants), coarse mass (larger particles that include dust and pollen), and organic carbon (from fires, vegetation, and human activities). The light extinction caused by ammonium sulfate at White Sands is almost as large than that caused by all sources of haze under natural conditions.

Visibility is one component of a comprehensive air resources monitoring program at White Sands NM conducted by the NPS Air Resources Division. Information gathered via long-term monitoring supports evaluation of compliance with legislative requirements of the Clean Air Act, regional haze guidelines, National Environmental Policy Act, other applicable laws and NPS policies.

The Chihuahuan Desert Inventory & Monitoring Network identified visibility as a high-priority vital sign for monitoring at White Sands NM. The network's protocol harvests data provided by the Air Resources Division and produces these briefs. The objectives of air quality monitoring at White Sands NM are to determine the conditions and spatial and temporal trends in ozone, nitrogen deposition, sulfur deposition, and visibility-reducing pollutants, and determine how these measures vary with associated vital signs (such as vegetation community composition, exotic plant status, and climate). The Chihuahuan Desert Network is one of 32 inventory and monitoring networks for the national park system. Networks facilitate basic inventories, conduct long-term monitoring, and deliver key scientific data to park managers and partners.

Additional information about air resources in national park sites is available at https://www.nature.nps.gov/air/.





Note: Clearest days are the 20% of sampled days where visibility is most clear.

* Light extinction: the loss in light intensity due to scattering and absorption measured in inverse megameters (1/Mm).

**Natural visibility conditions are those estimated to exist in a given area in the absence of human-caused visibility impairment.

IMPROVE Monitor ID: BOAP1, NM

Data are from Air Quality and Trends, White Sands National Monument (https://www.nature.nps.gov/air/data/products/parks/index.cfm; accessed April 20, 2017)